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ALLOCATION OF LAND RESOURCES IN SEMI-
ARID AREAS: A SIMULATION BASED ON THE
EAST AFRICAN EXPERIENCE

by

David J. Campbell and
Jean Palutikof

DISCUSSION PAPER NO. 262

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ABSTRACT

This paper describes a simulation game prepared as an exercise for a course entitled 'Arid and Semi-arid Lands. their Status and Potential' which the authors taught in the Department of Geography of the University of Nairobi during the 1977 - 78 academic year. The simulation was intended to tie together the socio-economic and the physical aspects of arid and semi-arid areas. It is concerned with the problem of land allocation in a situation where there is land-use conflict. The participants are divided into groups of farmers and pastoralists and are required to adjudicate the land in a manner acceptable to the government. The problem is complicated by a government proposal to set up a national park in the area. The subject of the simulation is relevant not only to students of arid and semi-arid areas, but also to those interested in resource management in developing countries. Sufficient information is given in this paper to allow the reader to set up the simulation.

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INTRODUCTION

This paper presents a role-playing simulation exercise which is designed to examine a wide range of issues involved in land-use planning in the arid and semi-arid areas of developing countries. These regions make up a large proportion of the land area of many developing countries and their importance to national development is increasing as the higher potential lands become more fully utilised.

Strategies for the development of arid and semi-arid areas must take into account not only their economic and social conditions, but also their environmental characteristics. These areas are particularly vulnerable to environmental degradation through the processes of desertification and drought. The United Nations Conference on Desertification (1977) recognised that improper land use is a major contributor to desertification and that in many developing countries overgrazing and the clearing of vegetation for agriculture and firewood are contributing to desert creation in semi-arid areas. If such areas are to play a positive role in national development, careful land-use planning will be essential to assure the welfare of the population and to maintain the productivity of the land.

A number of major issues which arise in the process of land-use planning form the basis for the simulation.

Land Pressure

The high birth rates and rapidly growing populations of developing countries affect both the farmers and pastoralists of semi-arid areas, but the problem is felt most severely by farmers. Population growth rates are usually higher amongst farmers, and in addition, in recent years semi-arid agricultural areas have had to absorb not only the natural increase of their indigenous people but often also the overflow from the overpopulated high potential areas within the same country. As the population density increases, agriculture becomes more intensive and fallowing decreases, leading to lower yields and greater soil erosion. The process may be accelerated where in-migrants introduce inappropriate cultivation techniques transferred directly from humid regions.

Where pastoralism is the traditional land-use system, population growth leads to an increase in herd size in an attempt to assure subsistence. As the grazing resources are finite, there are dangers of overstocking, deterioration in the quantity and quality of vegetation, and increased soil erosion.

Land-Use Conflicts

Due to their higher population growth rates, farmers are extending their activities into areas which pastoralists, often of a different ethnic group, have traditionally regarded as their own. This expansion is commonly into the dry season grazing lands-areas which maintain some grass cover and have a water supply even at the height of the dry season and which therefore have some agricultural potential. Agriculture may provide a greater economic return in these marginal areas. However, expansion into the dry season grazing lands may lead to the collapse of the pastoral economy which is the only viable use of the low potential rangelands.

These conflicts may be intensified where national boundaries are drawn without reference to traditional land-use practices. The position of the Mali-Niger border, for example, has forced the Tuareg nomads to alter their seasonal movements, while in East Africa some Maasai have been affected by the closure of the Kenya - Tanzania border.

Tourism and Wildlife

It is the view of some governments that the largest contribution that semi-arid areas can make to the national economy is through tourism associated with wildlife viewing. Preservation of wildlife for this purpose is usually accomplished through the creation of national parks. These parks are commonly sited in areas where wildlife is present throughout the year, and they include sources of dry season water and pasture which were traditionally available to both the wildlife and the domestic livestock owned by pastoralists. The enclosure of such areas within national parks results in the exclusion of pastoralists, forcing them to seek dry-season grazing elsewhere. The benefits of the tourist industry based on wildlife viewing may be great at the national level, but the costs are borne locally by those whose resource base is depleted.

International Pressure.

Where wildlife conservation is concerned, the range of policies available to national governments may be constrained by the necessity to respond to international pressure which is often based on the view that any

activity other than conservation through isolation in parks is a threat to wildlife.

External pressures are also brought to bear through the activities of international aid-giving bodies. Increasing amounts of aid are being allocated for the development of semi-arid lands, and the recipient governments are having to prepare plans to utilise these funds. Too often these plans appear to be hastily conceived and poorly implemented, so that their long-term contribution to the wellbeing of the local people may be limited.

THE SIMULATION

This simulation is an exercise in resource management for semi-arid areas which involves consideration of social, economic and environmental factors in land-use planning. As such it might be useful for teachers or lecturers conducting courses in, for example, resource management, development planning, range management and agricultural development in dry land areas.

The exercise concerns land adjudication and development planning for the northern, semi-arid regions of the fictional country of Mageria.¹ These areas are occupied by pastoral and agricultural peoples who are beginning to compete for land and water resources in the area. The participants in the simulation assume the roles of pastoralists or farmers and they are asked to prepare land adjudication plans for the area such that the interests of their group are protected. A situation is presented of competition between the pastoralists and the farmers over the use of specific land and water resources, and the objective is to resolve the conflicting interests in these resources.

The simulation was prepared for use in a course introduced in the Department of Geography of the University of Nairobi, in the 1977 - 78 academic year, entitled 'Arid and semi-arid lands: their status and potential.' The coursework prior to the simulation deals with the physical characteristics of arid and semi-arid lands-climate, soil, vegetation and geomorphology -and with the principles of selected land uses in such areas - pastoralism, agriculture and wildlife/tourism. The simulation is a practical exercise in which the students integrate information from their lectures, their reading and from their own experience in a problem-solving situation. In seeking a solution to the land-use conflicts in northern Mageria, they gain an appreciation of the

1. It must be emphasised that all the materials used in the simulation are fictitious.

complex issues which face those involved in planning for arid and semi-arid areas. The simulation demonstrates the complexity and interrelatedness of development issues much more clearly than would be possible in a lecture situation, because it involves the students in making decisions for themselves; rather than being told that the situation is complicated, they come to realise it for themselves.

PREPARATION FOR THE SIMULATION

Two days before the simulation the students receive Document 1A, 'Background Information'. These notes provide general information on the physical and socio-economic characteristics of the area where the simulation is set, and are designed to familiarise the participants in advance. The maps shown in Figures 1 and 2 are attached to these notes, and also the rainfall data in Table 1.

The instructors assign each student to a group of farmers or pastoralists. Groups of four to six people have been found to be most satisfactory, and if necessary there can be two or three groups of each type. Each group requires a large map of the Lake Ann area (Figure 2) in order to illustrate its proposals.

STAGE 1: LAND ADJUDICATION PROPOSALS.

At the start of the game the students sit in their groups and each receives the following documents to read: either 1B, 'The Tuai Pastoralists',² or 1C, 'The Sengot Farmers' according to which group he or she belongs; 1D 'East African Chronicle: Land Adjudication', 1E, 'Land Adjudication Act: Government of Mageria, 1968'; and the map given as Figure 3, showing land use in the Lake Ann area.

The students are told that apart from the documents which they each receive there are Information Cards available to assist them in reaching a decision (see Appendix 1).

After allowing sufficient time for reading the documents, the instructor introduces the first stage of the simulation, emphasising the areas of land-use conflict shown in Figure 3. Each group is then given the task of preparing a

2. All names are fictitious.

land adjudication plan for the area. This plan must both protect the interests of the group and be acceptable to the District Commissioner (D.C.)³. The D.C. is in turn responsible for presenting the final plans to the government. This role may be played by a student or the instructor.

STAGE 2: REPORTING THE PROPOSALS AND DISCUSSION

The groups require between twenty and thirty minutes to produce a land adjudication plan. The D.C. then calls a baraza (meeting) at which each group presents its proposals and the case for their acceptance. At the end of each presentation a short time is spent on discussion and questions from other participants. For four groups, half an hour should be allowed for presentations. On the basis of these, the D.C. then prepares a composite proposal. This is explained and reasons given for the acceptance or rejection of suggestions made by the different groups. A map should be drawn demonstrating the land adjudication proposals to be sent to the government.

At this point a break for coffee (or tea) is taken, during which the following material is distributed: Document 2A, 'East African Chronicle: Border Closed Yesterday'; and Document 2B, 'East African Chronicle: World Bank Plan...'

STAGE 3: THE NATIONAL PARK

At the end of the break the D.C. calls a second baraza. He explains that due to recent events - he refers to Documents 2A and 2B - the Government of Mageria has rejected his Land Adjudication Plan for the Lake Ann area. It is now necessary to consider a World Bank plan for a northern Integrated Tourist Circuit (ITC) for Mageria which incorporates the Lake Ann area. According to this plan, Lake Ann and its surroundings are to be set aside as a National Park.

The Government of Mageria has accepted the World Bank plan in principle but is prepared to amend it in detail to accommodate local needs. The participants are thus requested to review the Land Adjudication Plan in the light of the proposed ITC and the new status of the Lake Ann area. Each group must now examine the plan and prepare modifications to it, bearing in mind three points: the interests of the group, the national need for a northern ITC, and conservation of the Southern Pugot antelopes. The students receive the following documents: 2C, 'Proposal for an Integrated Tourist Network for Mageria' with the maps shown in Figures 4 and 5 attached; 2D, 'The Pugot'; and either 2E, 'Costs and Benefits of the National Park to Pastoralists' or 2F 'Costs and Benefits of the National Park to Farmers'. With an exceptionally bright group of students

3. Unfamiliar terms are explained in the glossary in Appendix 2

it may be possible to dispense with these. Each group then prepares a revised plan to be presented at a baraza. One hour is needed for this exercise.

STAGE 4: PREPARATION OF A LAND ADJUDICATION PLAN TAKING ACCOUNT OF THE WORLD BANK PROPOSALS FOR A NORTHERN ITC.

In the final stage the D.C. again calls a baraza at which the revised plans are presented and discussed. The D.C. prepares an official plan which should be an acceptable compromise between the needs of the Government, the Sengot, the Tuai, and the Southern Pugot.

Discussion of the D.C.'s plan ends the simulation. The whole exercise takes between three and four hours when there are two groups of farmers and two of pastoralists.

STAGE 3: THE NATIONAL PARK

At the end of the break the D.C. calls a second baraza. He explains that due to recent events - he refers to documents 2A and 2B - the Government of Nigeria has rejected his land adjudication plan for the Lake Ann area. It is now necessary to consider a World Bank plan for a northern Integrated Tourist Circuit (ITC) for Nigeria which incorporates the Lake Ann area. According to this plan, Lake Ann and its surroundings are to be set aside as a National Park.

The Government of Nigeria has accepted the World Bank plan in principle but is requested to speed it in detail to accommodate local needs. The participants are thus requested to review the land adjudication plan in the light of the proposed ITC and the new status of the Lake Ann area. Each group must now examine the plan and prepare modifications to it, bearing in mind three points: the interests of the group, the national need for a northern ITC, and conservation of the Southern Pugot and/or the Sengot. The students receive the following documents: 2C, 'Proposal for an Integrated Tourist Circuit for Nigeria' with the maps shown in Figures 4 and 5 attached; 2D, 'The Pugot'; and either 2E, 'Costs and Benefits of the National Park to Pastoralists' or 2F, 'Costs and Benefits of the National Park to Farmers'. With an exceptionally bright group of students

THE DOCUMENTS⁴

1A. Background Information.

Mageria is a country somewhere in Eastern Africa. The major features are shown in Figure 1. At the 1975 census the total population was recorded as 10,757,000. There are nine major tribes, of which the two largest are the Mossa and the Fulo, and seven minor tribes.

One of the more remote and underdeveloped parts of the country is the area shown in Figure 2. It is occupied by one of the smaller major tribes, the Sengot, and their neighbours, the Tuai pastoralists. They occupy the Sengot Hills and the Tuai Plains respectively.

Physical Features of the Area. The Sengot Hills extend 150 km. from north to south, and 100 km. from east to west. The summits are generally between 2500m. and 3000 m. On the west the hills are cut off sharply by a steep escarpment which drops to the Rift Valley. On the east they slope more gently to the Tuai Plains which lie at about 800 m. These plains slope gently northeastward towards the Ewaso Ngare River in Maurethalia. In the east they are broken by the Iletan Hills, which rise to over 1700 m.

The drainage pattern of the region is shown in Figure 2. There are three major rivers flowing out of the Sengot Hills: The Orua and the Kora into Lake Ann, and the Rurati flowing directly northeastwards towards the Ewaso Ngare. The course of the Rurati across the Tuai Plains is dry for much of the year due to the high evaporation rates. A few streams also flow onto the plains from the Esbats and Iletan Hills, but dry out quickly.

The soils and the vegetation differ markedly from the hills to the plains. The soils of the hills are deep and fertile, of volcanic origin. They support a natural vegetation of forest with thick undergrowth on the slopes, and a less luxuriant forest on the drier lower slopes. Much of the upland forest has been cleared for cultivation and inadequate soil conservation has resulted in considerable soil erosion. This problem is becoming more severe as farmers clear more land on the lower slopes of the Sengot Hills.

⁴ As explained in the introduction, all these documents are fictitious.

The soils of the plain are sandy and shallow. They are derived from the underlying basement rocks and are subject to severe sheet erosion during the rains. They support a sparse savanna-type vegetation which varies markedly between the wet and dry seasons. During and after the rains, annual and perennial grasses provide a thick ground cover. By the end of the dry season large areas of bare earth are exposed. Occasional pockets of clay soils are found in depressions and along the valleys of ephemeral streams. These areas support grasses and trees all year round.

The climate is characterised by high temperatures and a bi-modal rainfall distribution; March to May and October to December are the wettest periods. The amount of rainfall received varies with altitude: Zindat has a mean annual rainfall of 785 mm., Koto 475 mm., and Nyore only 179 mm. Drought is a recurrent hazard, particularly in the medium and low potential areas. Several drought years have occurred within the memory of many inhabitants-1948, 1955, 1961 and 1974-6.

Population and Land Use. The total population of the area increased from about 630,000 in 1965 to 865,000 in 1975. The principle tribes with their 1975 population figures are:-

Sengot	762,550 (88% of total)
Tuai	83,360 (9.6% of total)
Mossa	16,370 (1.8% of total)

The Sengot are an agricultural people occupying the Sengot Hills. Traditionally they were restricted to the upper slopes of the hills by the raiding activities of the Tuai. They developed an economy based on the cultivation of maize, beans and vegetables which were grown primarily for subsistence. Some trade took place with the Tuai. The defeat of the Tuai in 1923 by the colonialists brought peace to the area and permitted the Sengot to abandon their nucleated settlement pattern and clear a much wider area for cultivation. Much of this expansion, particularly recently, has been into the lower, medium potential areas of the hills. The land-use system there is one of shifting agriculture and pastoralism. Millet is grown for subsistence, and most farmers also keep a few cattle and a number of goats. The sale of charcoal to the high potential zone is a major source of cash. Under increasing population pressure the length of the fallow periods in the shifting agricultural system has been curtailed.

A small number of Sengot (some 80 families) have abandoned the

Sengot Hills entirely and occupied a strip (the Sengot Strip) about eleven kilometres long on the shores of Lake Ann. There they practice flood-retreat agriculture and pan irrigation, growing maize and vegetables. A further group has moved into the Iletan Hills. Here they grow subsistence crops during the wet season. They number about 200 families and cultivate approximately 400 ha. of land, but this is scattered over a very wide area.

The Tuai are pastoralists who graze their animals primarily in the Tuai Plains and on the lower slopes of the bordering hills. Their land use follows a seasonal pattern. During the wet seasons they graze their herds in the plains; they spend the dry season in the hills where water and pasture resources are best. In order to ensure access to these dry season grazing areas the Tuai traditionally raided and subjugated the farmers who lived there.

Since their defeat at the hands of the colonialists in 1923, the Tuai have undergone a curtailment of the area available for grazing. Peaceful conditions have enabled farmers to move into the lower slopes of the hills, out to the lake shore and onto the Iletan Hills. These are the best-watered dry season grazing areas in the south. The movement of animals north to the Ewaso Ngare river was made difficult by the creation of the border with Maurethalia in 1935, and almost impossible after the war between Maurethalia and Mageria in 1963.

This restriction of the grazing area has occurred at a time of increasing animal numbers. The colonialists brought vaccinations which reduced the threat of disease, and between 1948 and 1961 only one drought limited the growth in numbers. There was some reduction during the 1961 and 1974-76 drought years, but overgrazing due to excessive livestock numbers is still a major problem.

Infrastructure. The principal roads in the area are shown in Figure 2. All are murrum roads except that from Naradi to the capital, which is tarmac. In the plains the roads are subject to flash flooding where they cross ephemeral streams. The murrum roads in the hills have steep gradients and rocky outcrops.

There is a grass airfield at Naradi and a strip with no facilities at Tawa.

The district headquarters is located at Zindat, with a population of 7,800. This town also has a small hospital with 30 beds, a bank and a secondary boarding school. Primary schools are located at Koto, Tawa, and Sott, as well as at Zindat. There is a dispensary at Koto. A market is held at Zindat on Tuesdays and Saturdays, and on Thursdays at Koto. A District Officer is stationed at Nyore and at Tawa.

Other Information. The District Commissioner's Reports for 1972 to 1977 have discussed at length the problems of tribal conflict in the area. The major issues are:-

1. Cattle raids by Tuai and Gulani across the northern frontier. Gulani have been reported stealing cattle as far south as the northern shores of Lake Ann and skirmishes between the security forces of Maurethalia and Mageria have been reported with disquieting frequency.
2. Within the area, clashes between Tuai pastoralists and Sengot farmers are occurring more frequently. The pastoralists have frequently complained about the Sengot movements into the Iletan Hills and onto the shores of Lake Ann. Violence occurred during the drought of 1974-76 as the Tuai drove their cattle through cultivated fields to their traditional watering places. The Tuai leaders called on the D.C. to evict the Sengot from the Iletan Hills, but nothing was done.

The D.C. has appealed to the Land Adjudication Commission to institute procedures leading to the adjudication of the remaining undemarcated area. The high potential zone of the Sengot Hills was adjudicated in 1970, and it is hoped that much of the conflict in the medium and low potential areas will be resolved when adjudication is complete.

Table 1. Mean monthly rainfall(in millimetres).

	Nyore	Tawa	Koto	Zindat	Naradi
Jan.	10	10	27	56	24
Feb.	7	8	18	48	42
March	21	20	46	79	88
April	48	99	71	144	151
May	25	27	36	124	157
June	7	0	27	22	97
July	14	0	19	6	73
Aug.	10	0	16	15	45
Sept	3	2	37	13	108
Oct	13	40	31	45	139
Nov.	13	46	95	152	165
Dec.	8	9	52	81	103
Annual	179	261	475	785	1191

Figure 1. Map of Mageria.

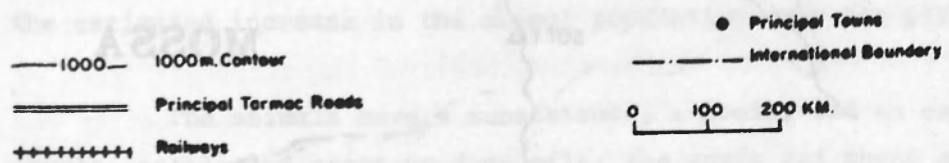
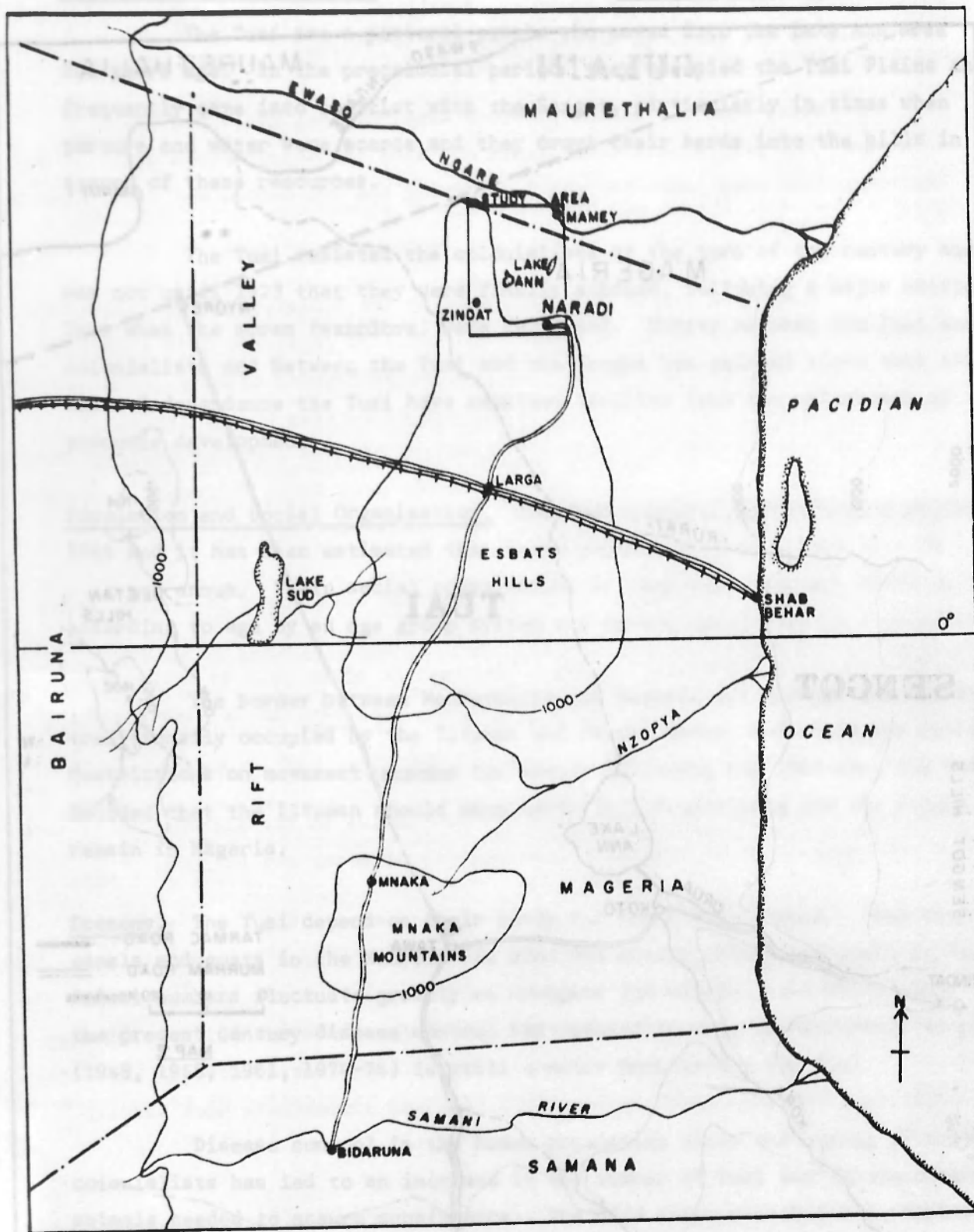
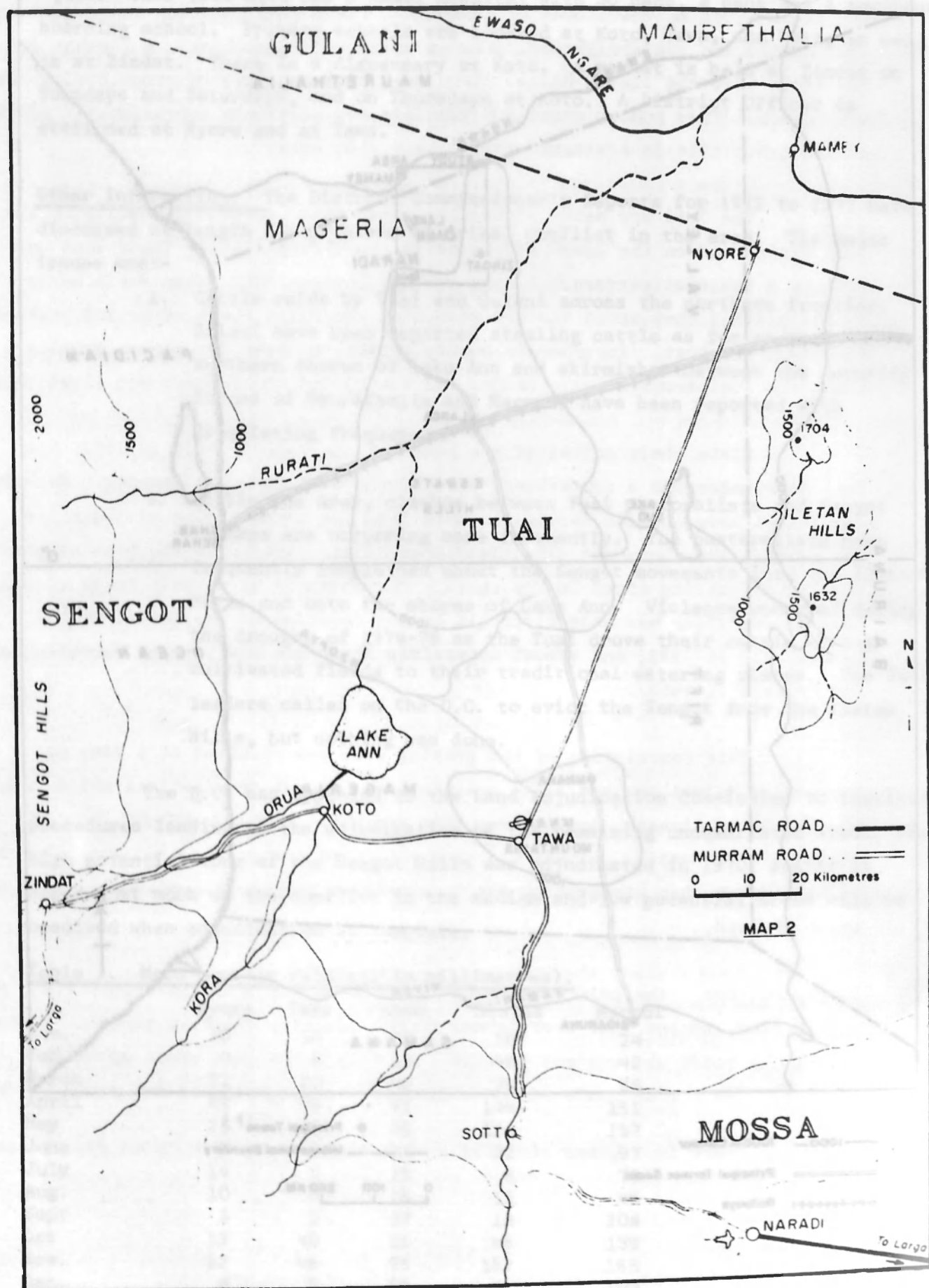


Figure 2. The Study Area.



1B. The Tuai Pastoralists

The Tuai are a pastoral people who moved into the Lake Ann area 200 years ago. In the precolonial period they occupied the Tuai Plains and frequently came into conflict with the Sengot, particularly in times when pasture and water were scarce and they drove their herds into the hills in search of these resources.

The Tuai resisted the colonialists at the turn of the century and it was not until 1923 that they were finally subdued, following a major battle at Tawa when the moran (warriors) were decimated. Enmity between the Tuai and the colonialists and between the Tuai and the Sengot has existed since that time. Since independence the Tuai have remained isolated from the mainstream of economic development.

Population and Social Organisation. The Tuai numbered approximately 68,000 in 1965 and it has been estimated that their population growth rate is 2.2% per annum. Their social organisation is complex. They are differentiated according to age by an age group system and across age-groups by a clan system.

The border between Maurethalia and Mageria cut through the territory traditionally occupied by the Iltuman and Poluka clans, and since the increased restrictions on movement across the border following the 1963 war, the Tuai decided that the Iltuman should move north into Maurethalia and the Poluka should remain in Mageria.

Economy. The Tuai depend on their herds for their subsistence. They keep camels and goats in the Maurethalia area and cattle, sheep and goats in Mageria. Animal numbers fluctuate greatly as droughts and disease take their toll. In the present century disease control has reduced losses, but recurrent drought (1948, 1955, 1961, 1974-76) is still a major problem for the Tuai.

Disease control in the human population since the coming of the colonialists has led to an increase in the number of Tuai and in the number of animals needed to assure subsistence. The data sheet attached illustrates the estimated increase in the animal population over the period 1965 to 1990.

The animals have a subsistence, a social and an exchange value. The camels, cattle and goats produce milk; the goats and sheep are valued particularly for their meat. Wealth is measured by the size of herd owned, camels and

cattle being the most valued animals. Marriages, births and other social events are marked by the exchange and/or slaughter of animals.

Milk, meat and animal products (leatherwork, etc.) are items of exchange. The predominant trade links are with the Sengot whose grain is an important food supplement for the Tuai during the dry season and particularly during a drought.

Recently attempts have been made by the Ministry of Agriculture to persuade the Tuai to market animals. The Ministry considers this effort a failure, however, as the Tuai have refused to sell their animals. Tuai leaders accuse the Ministry of attempting to enforce destocking and of trying to disrupt the Tuai economy. The local Livestock Officer explains that the Ministry instituted its scheme at a time when the herds were small following a drought and offered low prices which the Tuai were unable to accept.

Since independence, some Tuai families have begun to enclose small patches of land, particularly in the better watered hillslope areas, and then to rent the land to Sengot farmers. The rent is often paid as a specified proportion of the crop. In a very few cases, Tuai have themselves begun to cultivate.

Land Use. The Tuai land-use system is responsive to the alternation of wet and dry seasons; to the seasonal availability of water and pasture.

The traditional dry season grazing areas are the lower slopes of the Sengot, the Esbats and the Iletan Hills, and the area around Lake Ann. These areas provide a reliable and permanent water supply and adequate grass for the animals, though towards the end of the dry season the availability of forage is limited and shrubs supply most of the fodder. In periods of drought the Tuai drive their animals higher up the hillslopes and concentrate more heavily around the lake.

The onset of the rains stimulates the growth of annual and perennial plants in the plains. The Tuai move their herds away from the well-watered dry season areas according to the watering needs of the different types of animals. Thus the camels leave first and return last while the cattle and sheep leave last. As the rains subside, the herds are moved back towards the hillsides and the lakeshore for the dry season.

In recent years the Tuai have relied more and more heavily upon the grazing and water resources on the shores of Lake Ann for their dry-season water and pasture. This is because the Sengot and Mossa farmers have to an increasing extent occupied the traditional hillside dry-season grazing areas of the Tuai.

Land Tenure. Land tenure amongst the Tuai has always been on a communal basis. Families or clans tend to occupy the same areas from season to season, but this does not prevent other families or clans from grazing their herds in those areas. In theory all the land occupied by the Tuai is owned by the tribe, but in practice groups of Tuai tend to occupy specific areas.

Each Tuai group has a favourite dry-season location and usually moves according to a long established pattern. In periods of drought, however, these mobility patterns are disrupted as the herders gather in the few remaining places with favourable grazing and water resources.

Each Tuai family has the right to enclose an area near their boma. Traditionally this area was used to graze the young animals before they were strong enough to move with the main herds. More recently, increasing numbers of Tuai have enclosed areas for cultivation. The farming is done either by Sengot women married to Tuai or by Sengot farmers who have rented the land from the Tuai. In some areas around the lake, the land is entirely under cultivation and supports considerable numbers of farmers, some of whom have been there for over five years.

Problems concerning land have affected the Tuai since 1960. The closure of the border with Maurethalia and the expansion of the area under cultivation have begun to worry many Tuai leaders. Government proposals to demarcate the medium-potential and rangeland areas, and present title deeds, are seen as an opportunity to gain legal title to Tuai land and thus prevent further losses.

The Tuai are very concerned about the Sengot farming the lower slopes of the Sengot Hills and the strip along the lake. Many are tenants on Tuai enclosures, but others are squatters. These farmers are petitioning the Land Adjudication Commission for title deeds to the areas they occupy. In view of this, a number of Tuai are attempting to remove the Sengot agriculturalists from these areas. Frequent squabbles are occurring, particularly when the Tuai drive their animals through the Sengot fields to water at the lake.

The objectives of the Tuai are to receive title deeds either communally or as individuals to the areas traditionally available to them both in the wet and dry seasons. This would enable them to maintain their current pastoral way of life and to adapt to the processes of modernisation without their economy being threatened by land-use changes.

Data Sheet - Pastoralists.

District Area	80,000 sq km	
High-Potential	5,000 sq km	Sengot Hills
Medium-Potential	10,000 sq km	Lower Sengot Hills
Rangeland	45,000 sq km	Lake Ann Plains

Tuai Population

1965 (Census)	68,000
1975 (estimate)	83,360
1985 (estimate)	103,625
Estimated growth rate	2.2% p.a.

Animal Population (1965 estimates based on 2.2% p.a. growth)

YEAR	CATTLE	SHEEP	GOATS	LSU ^a	AREA(ha) ^b
1965	340000	275000	623000	429800	3223500
1975	409827	327292	741470	516704	3875280
1985	509459	406859	919924	642137	4816028
1990	565800	453627	1025667	713729	5352968

Animal Population (Revised estimates following 1976 drought losses)^c

YEAR	CATTLE	SHEEP	GOATS	LSU ^a	AREA(ha) ^b	% of 1965 est.
1976	209421	83623	507714	268554	2014155	51
1980	428058	341951	774454	539688	4047660	94
1985	481321	386237	875734	607518	4556385	95
1990	542765	434307	981984	684394	5132955	96

- LSU is a Livestock Unit. A 250 kg. cow = 1 unit. One sheep or goat = 1/10 LSU.
- In the Tuai Plains, 1 LSU requires 7.5 ha for grazing in the dry season. The area shown is that required to graze the animals at this stocking rate.
- At the end of 1976 it was estimated that the cattle population had been reduced by one half, the sheep by two-thirds and the goats by one-third.

WET SEASON GRAZING AREA

The Tuai Plains

DRY SEASON GRAZING AREA

The slopes of the Iletan Hills, the Sengot Hills and the Esbats hills .
The shores of Lake Ann .

WET SEASON WATER SOURCES

The Upper Orua, the Orua Rivers
Pools and lakes in the Tuai Plains .
Tsetse infestation of the river valleys in the hills prevents the use of these streams in the wet season.

DRY SEASON WATER SOURCES

The permanent streams and rivers of the Esbats, Sengot and Iletan Hills.
The water of Lake Ann .

ANIMAL WATERING REQUIREMENTS

Should be daily but cattle can go for three days without water.
Small stock should be watered daily.

Maximum range from water

Cattle 15 km
Sheep 6 km
Goats 20 km

SETTLEMENT ON HILLS

Iletan Hills - 200 families area 4000 ha - widespread settlement.
Sengot Strip - 70 families area 111 km along lake, 100m wide.

1C. The Sengot Farmers

Physical Background of the Area. On the basis of the amount of rainfall received, the Sengot Hills may be divided into two zones: the high-potential areas and the medium-potential areas. The dividing line between the two zones is marked by the 1500 m. contour (see Figure 2), which coincides approximately with the 600 mm. mean annual rainfall isohyet. Above this line are the high-potential areas; below it down to about 800 m., which is the level of the Tuai Plains, are the medium-potential lands.

In the high-potential areas the mean annual rainfall varies from about 600 mm. to 1000 mm. (see Table 1), depending largely upon altitude. Most rainfall occurs during the two wet seasons. The variability is low, and the rains are generally reliable. Little natural vegetation remains: most of the land has been cleared for cultivation.

The medium-potential lands have a mean annual rainfall of between 500 and 600 mm, but here the variability is much higher and droughts occur, most recently in 1975-6. The soils are red-brown volcanic, but much shallower and less fertile than in the high-potential regions. Scattered low trees with thin undergrowth form the natural vegetation, with patches of bare soil in between. However, since this is an area of shifting agriculture, much of this 'natural vegetation' is in fact secondary growth.

Land Use Systems and the Economy. The high-potential areas of the hills have been occupied by the Sengot for about 200 years. During this time, they have developed a stable sedentary agricultural system. The farms are small, averaging 1.4 ha., and virtually the whole area is cultivated. Despite the intensity of land use, soil erosion is minimal and has never been a serious problem. On cultivated valley sides, either the land is terraced or strip cultivation is practised, alternating napier grass with the more erosion-prone food crops. The land was adjudicated in 1969, and since then the standards of land husbandry have risen remarkably.

The commonest crops are food crops: maize, beans, vegetables, etc. These are consumed by the farm households, and any excess is traded in exchange for cattle, which represent the wealth of the individual farmer. A rich farmer will have a herd of up to thirty cows, and even the poorest will have one or two. Small herds are grazed along the road-side and on any patches of unused

land. The larger herds are sent down to the medium-potential lower hillslopes to graze.

The exchange of food crops for cattle takes place either amongst the Sengot themselves or with the Tuai. Apart from this, there is very little external trading. When cash is required to buy clothes or to pay school fees, a cow will be sold, but no regular trading patterns have been established. This is largely due to the poor communication links, both within the area and with the rest of Mageria.

Cash crops have only recently begun to have any significance in the area. There is now a coffee cooperative at Zindat with about 300 members, and coffee has been harvested since 1973. However, the average area under coffee per farm is only 0.5 ha. Because of the very poor road linking Zindat to Larga, transport of the coffee out of the region is costly, and the payments to farmers are low. There is no doubt that the area under coffee would increase substantially should this problem be overcome. The same applies to milk production. A small number of farmers have begun to keep grade cows, but the local market is small and it is at present impossible to export the milk.

In the medium-potential areas the land was traditionally used only for grazing the herds of the farmers who live on the higher slopes. In the last fifty years this has changed. The reasons are threefold:

- 1) Until 1923, the Tuai raided into the foothills of the Sengot Hills and stole cattle. This prevented any kind of permanent settlement by the Sengot. In 1923, the war between the Tuai and the colonialists ended in a heavy defeat for the Tuai. Subsequent police activity by the colonialists put an end to raiding by the Tuai, although they still use the foothills for dry season grazing.
- 2) Population pressure along the central spine has been gradually increasing
- 3) Land adjudication of the high-potential areas in 1969 left a substantial number of people without land.

Therefore since 1923, the medium-potential areas have been available for settlement. Since about 1930, people have begun to move into the area. This migration has accelerated since 1969. The line of settlement has moved gradually down the hills, and now reaches almost to the level of the Tuai Plains.

Until recently, shifting agriculture was practiced as well as pastoralism. Small plots were cleared for millet, sorghum and cowpeas. Cattle and goats formed the principal wealth of the people and cash income was also obtained by the sale of wood and charcoal to the high-potential areas. Since 1969 however, this shifting agriculture system has begun to break down. With increasing population pressure, it is no longer possible to leave the land under fallow for long periods. Soil erosion is beginning to be a serious problem, and there is no doubt that the fertility of the land is decreasing.

Farming is not very profitable in the medium-potential areas of the Sengot Hills, and some of the farmers displaced from the central spine were unwilling to settle in this area. Instead, they moved to the shores of Lake Ann or to the Iletan Hills. The settlement around Lake Ann began in 1970 when three families moved to the area. The number has been growing steadily, and there are now 70 families along the southeastern shore of the lake. They occupy a strip about 11 km. long by 100 m. wide, now known as the Sengot Strip. Each family has about two ha. of land. Food crops such as maize, peas, beans and other vegetables are grown using flood retreat and pan irrigation. Until 1975, the surplus was exchanged with the Tuai for animal products, but this trade has now ceased due to the poor relationships between the two groups.

The Sengot originally occupied this land with the agreement of the Tuai in exchange for money. In 1975 however, the elders of the Tuai became concerned at the extent of the settlement. They felt that their access to the valuable fresh water of Lake Ann was being seriously threatened, and that too much grazing land in the vicinity was being cultivated. They attempted to persuade the Sengot to leave, using threats of violence. They were unsuccessful, and subsequently additional families have settled in this area without the agreement of the Tuai.

Table 2. Number of families migrating to the Sengot Strip, 1970-6.

1970	3
1971	7
1972	10
1973	15
1974	15
1975	10
1976	10

Since 1975, the Tuai have begun to drive their cattle through the cultivated

area to the lake edge for watering. This is an attempt to re-establish their traditional rights to the land.

The history of the Sengot settlement in the Iletan Hills has been very similar. The first families moved to the area in 1965 and there are now 200. They grow subsistence crops in the wet season and keep cattle. The Tuai have petitioned the District Commissioner to remove the Sengot from this valuable area of wet season grazing, but no action has been taken.

Land Adjudication. The Sengot in the medium-potential hillslopes, the Sengot Strip and the Iletan Hills are petitioning the Government to adjudicate their land. The reasons for this are threefold:-

- 1) In the Sengot Strip and the Iletan Hills this is to protect their rights against the Tuai.
- 2) As the population increases in the medium-potential areas, it is necessary to demarcate individual land holdings. Hopefully, the individual plots will be large enough to allow substantial fallow periods. Also farmers with title deed to their land will be able to obtain loans for soil conservation purposes, and will have the incentive to do so.
- 3) Along the edge of the medium-potential areas the Sengot are extending the cultivated land out into the Tuai Plains. They now wish to establish their rights to this land.

Population. According to the 1975 Census the total number of Sengot in the area was 762,550. This represents a 3.3 per cent growth rate over the 1965 figure of 551,150. However, as can be seen from the data sheet, the bulk of the increase has taken place in the medium-potential areas. There is no doubt that this represents a migration from the high-potential areas. These were adjudicated in 1969 and there has since been considerable movement of the landless into the non-adjudicated medium-potential areas. In addition, there has been in recent years increasing land pressure in the high potential areas (see holding size and density figures) which has also led to migration.

However, migration out of the Sengot Hills into other Provinces of Mageria is estimated to be low, at about 3 per cent (i.e. at any one time 3 per cent of the total population is absent). Amongst the male 15-30 age group, the figure is estimated to be much higher - 12.5 per cent. Both rates are predicted to rise in the future.

Data Sheet - Farmers

Area

Total Sengot Hills	15,000 sq. km.
High-potential land	5,000 sq. km.
Medium-potential land	10,000 sq. km.

Total Population

Sengot Hills 1965 (Census)	551,150
Sengot Hills 1975 (Census)	762,550

Growth rate 3.3% p.a.

Projected population Sengot Hills 1985 1,055,046

High-Potential Areas

1965

1975

Population	269,320	327,450
Density/sq.km	53.86	65.49

Medium-Potential Areas

Population	281,830	435,100
Density/sq.km	28.18	43.51

HOLDING SIZE (estimated)

High-potential area	average approx.	.1.4 ha.
Medium-potential area	average approx.	2.5 ha.

1D. East African Chronicle

LAND ADJUDICATION TO PROCEED IN LAKE ANN DISTRICT

The Minister for Lands, the Hon. Mr. P. Mtwapa, today informed Parliament in response to a question from Mr. J. Kiangi (Zindat) that he has ordered the Land Adjudication Commission to proceed with the preparation of a plan to adjudicate the undemarcated areas of Zindat District. The Minister added that he hoped the extension to the hospital at Zindat would be completed before the end of the year.

1E. Excerpts from the Land Adjudication Act, Government of Mageria, 1968

The Land Adjudication Commission will be charged with the responsibility of organising the adjudication process and with that of making the final decisions regarding the granting of title to any particular portion of land.

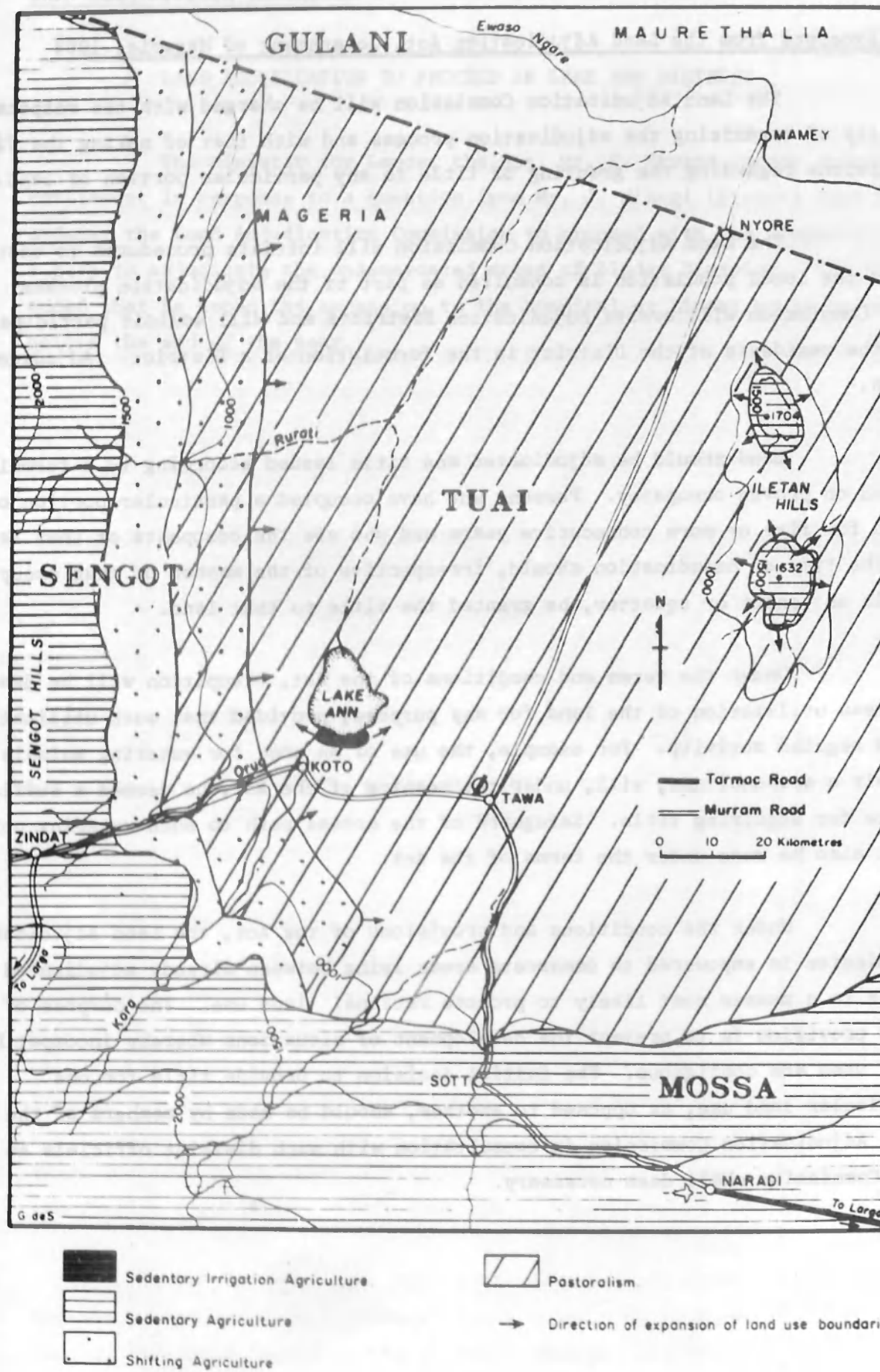
The Land Adjudication Commission will initiate procedures to ensure that the local population is consulted as part of the adjudication process. The Commission will create Adjudication Districts and will solicit participation by the residents of the District in the formulation of a District Adjudication Plan.

Land should be adjudicated and title issued according to a formula based on proven occupancy. Persons who have occupied a particular portion of land for five or more consecutive years and who are the occupants of that land at the time of adjudication should, irrespective of the manner of that occupation, be it as tenant or squatter, be granted the title to that land.

Under the terms and conditions of the Act, occupation will be deemed to mean utilization of the land for any purpose, provided that such utilization is a regular activity. For example, the use of an area for watering animals, albeit a seasonal use, will, under the meaning of the Act, be deemed a sufficient cause for acquiring title. Safeguard of the access path to such watering points will also be made under the terms of the Act.

Under the conditions and provisions of the Act, the Land Adjudication Commission is empowered to demarcate areas lying between already adjudicated plots in a manner most likely to promote rational land use. The purpose of this provision is to prevent the development of situations whereby incompatible land uses are contiguous. The initial decision to provide title for one particular land use, as opposed to another, should be made by members of the Land Adjudication Commission in consultation with such district officials as the Commission shall deem necessary.

Figure 3. Land Use in the Lake Ann Area.



2A. East African Chronicle

BORDER CLOSED YESTERDAY

The border between Mageria and Bairuna was closed at 16.30 hours E.A.T. yesterday. This followed a joint announcement by both governments last week of their intention to halt land traffic between the two countries. No reason was given.

Until yesterday there was unprecedented traffic across the border as people attempted to settle their last minute affairs. However, on the day of closure all was quiet.

It is not anticipated that the border closure will have any serious effects on the economy of Mageria, since there was little trading between the two countries. One serious implication, however, is the effect upon the tourist industry. Mageria was heavily reliant on the western tourist route between the Lake Sud and Southern Rift National Parks, passing through the world renowned Uhuru National Park in Bairuna. It is not clear whether the tourist attractions of Mageria alone will be sufficient to maintain the industry at its present level. Tourism is the second largest earner of foreign exchange.

An official of the Foreign Affairs Office today speculated that.....

The tourist industry rests in the hands of many private operators. It has been allowed to develop in a piecemeal fashion and there has been little attempt to co-ordinate the various attractions offered. Thus, for example, it is impossible to visit the two northern national parks of Mura and Kool on one trip. The operators only provide separate tours to each of these parks.

This situation has been highlighted by the recent closure of the border with Bairuna. This has completely disrupted the only existing tourist circuit that Mageria possessed, linking the Lake Sud and Southern Rift National Park in Bairuna.

2B. East African Chronicle .

WORLD BANK PLAN FOR MAGERIAN TOURIST INDUSTRY
ANNOUNCED

The Hon. J. Mtwapa, Minister for Tourism, today unveiled plans for the development of a wholly Magerian tourist industry. The plan, which was developed after the closure of the border with Bairuna, calls for the creation of Integrated Tourist Circuits which will **link up the Magerian National Parks**. This has become necessary since it is no longer possible for visitors to Mageria to visit the Uhuru National Park in Bairuna. Details of the plan will be announced next week, but it is understood that three circuits are planned which will enable tourists to see all of Mageria's unique attractions.



2C. Wildlife Bank Proposal for an Integrated Tourist Network for Mageria - Excerpts

- I i Tourism is the second principal earner of Magerian foreign exchange. The £40 million earned from tourism last year represents nearly one third of all foreign exchange earnings.
- I ii The volume of tourism has increased at a rate of 20% per annum over the past six years and has a projected growth rate of 10% per annum up to 1985.
- I iii The 1977-82 Development Plan expenditures are based upon projected increases in revenues from tourism.
- I iv The tourist industry relies upon two principal attractions. First, the coast of Mageria has long been a popular resort amongst those able to afford the considerable expense of a holiday there. Its reputation rests upon its reliable sunshine, fine beaches, and coral reefs. In recent years the provision of cheap package tours and the building of many high quality hotels has allowed many more people to sample its attractions. Second, Mageria is justifiably famous for its wildlife. There are at the present time five national parks with seven lodges where the wildlife may be observed.
- I v The tourist industry rests in the hands of many private operators. It has been allowed to develop in a piece-meal fashion and there has been little attempt to co-ordinate the various attractions offered. Thus, for example, it is impossible to visit the two northern national parks of Mure and Kool on one trip. The operators only provide separate tours to each of these parks.
- I vi This situation has been highlighted by the recent closure of the border with Bairuna. This has completely disrupted the only existing tourist circuit that Mageria possessed, linking the Lake Sud and Southern Rift National Park in Bairuna.

I vii It is recommended that the Ministry of Tourism and the Ministry of Finance should prepare plans for setting up a number of Integrated Tourist Circuits which will link the existing national parks and the coast. The upgrading of roads, the provision of suitable accommodation, and the gazettement of new national parks will be necessary in certain cases.

I viii The recommendation of the World Bank is that these Integrated Tourist Circuits (ITCs) should be in the form outlined on the map attached to this section (Figure 4).

IV The Northern Integrated Tourist Circuit

IV i The proposed Northern ITC will link the existing national parks at Mure and Kool through the gazettement of a National Park at Lake Ann.

IV ii Lake Ann lies to the northwest of Mure National Park; Tawa town is 145 km. from the Mure National Park. The distance from Tawa westwards to Kool National Park is 160 km. Lake Ann is thus an ideal location for the creation of a National Park, as it will provide an intermediate location for tourist travelling from Mure to Kool.

IV iii The facilities existing at Mure and Kool National Parks are adequate to meet projected tourist needs until 1990. The emphasis of the Tourist Development Programme must be on establishing a national park with comparable tourist facilities at Lake Ann.

IV iv The existing roads from Mure to Kool via Tawa, Koto and Zindat, and the road from Larga to Zindat, are inadequate for the projected increase in traffic. It will be necessary to add an all-weather tarmac surface to these roads.

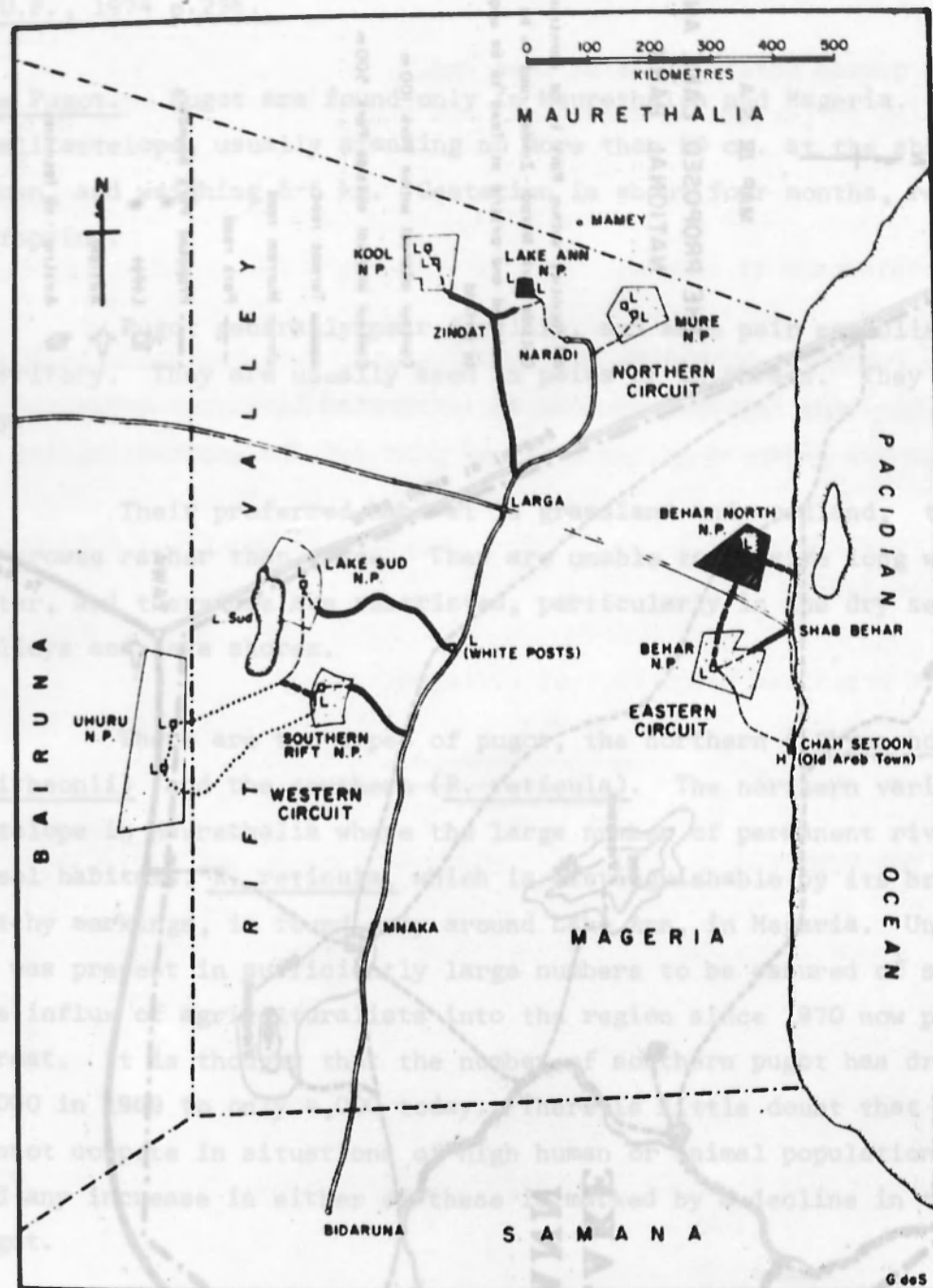
IV A The Lake Ann National Park

IV A i The area to be gazetted for the proposed national park is shown on the map attached to this section (Figure 5). Tourists will be attracted not only by the scenery, but also by the animal and birdlife which abounds around the lake. The traditional cultures of the Tuai and the Sengot will also be of interest.

- IV A ii Lake Ann is the natural habitat of the southern pugot, a small antelope which is found only in this area. This animal has recently suffered an alarming decrease in numbers, which is related to the influx of agriculturalists into the region. The pugot cannot survive in situations of intense land use. The national park will therefore also fulfill the significant role of protecting the pugot.
- IV A iii Two tourist lodges are proposed and their locations shown on the map (Figure 5). Each should provide accommodation for 80 to 100 visitors. It is anticipated that each will employ about 35 staff in various capacities: 10 waiters, 10 cleaners, 10 kitchen staff 5 management. It is recommended that as many of these employees as possible be recruited locally.
- IV A iv Apart from the direct employment opportunities offered by the lodges for local people, the tourist industry will stimulate local craft industries. The Tuai make a wide range of leather and bead articles, while the Sengot produce basketware.
- IV A v It is recognised that the creation of the national park will disrupt the present use made of the lake and lakeshore by the Tuai and the Sengot. The value of Lake Ann as a tourist resource far outweighs its value to the Sengot and Tuai, however. The creation of Lake Ann National Park will complete a Northern Tourist Circuit with potential earnings of £8 million per annum.
- IV A vi Compensation should be paid to those directly affected by the gazetting of the area as a National Park, and arrangements should be made with the Ministry of Agriculture for the provision of services, e.g., boreholes to replace the resources offered by the Lake and lakeshore.
- IV A vii In assessing compensation it should be noted that the Ministry of Tourism is considering implementation of a plan to compensate landowners for grazing by wildlife. Such payments, known as Wildlife Compensation Fees, are currently being made to the Gatana in Southern Mageria.
- IV A viii It is essential that the full cooperation of the people of the Lake Ann area be solicited for this proposal. It is recognised

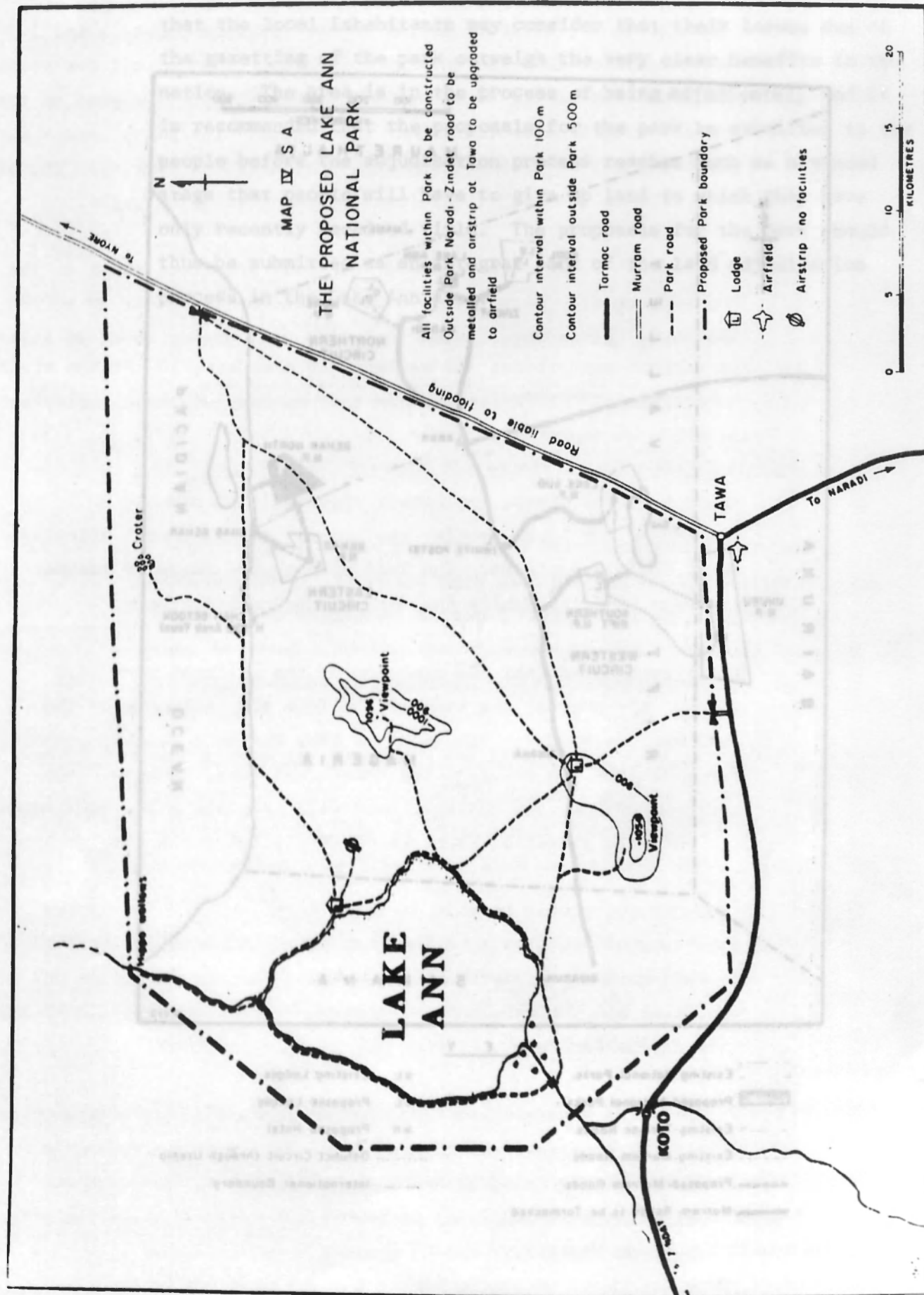
that the local inhabitants may consider that their losses due to the gazetting of the park outweigh the very clear benefits to the nation. The area is in the process of being adjudicated, and it is recommended that the proposals for the park be submitted to the people before the adjudication process reaches such an advanced stage that people will have to give up land to which they have only recently received title. The proposals for the park should thus be submitted as an integral part of the land adjudication process in the Lake Ann area.

Figure 4. Integrated Tourist Circuit Proposals for Mageria.



- | K E Y | | | |
|--------------------|------------------------------|-----------------|--------------------------------|
| [Solid Line] | Existing National Parks | [L in square] | Existing Lodges |
| [Dashed Line] | Proposed National Parks | [L in circle] | Proposed Lodges |
| [Solid Line] | Existing Tarmac Roads | [H in square] | Proposed Hotel |
| [Dashed Line] | Existing Murram Roads | [Dotted Line] | Defunct Circuit through Uzania |
| [Dotted Line] | Proposed Murram Roads | [Dash-dot Line] | International Boundary |
| [Thick Solid Line] | Murram Roads to be Tarmacked | | |

Figure 5. The Proposed Lake Ann National Park.



2D. Extract from P.C. Jackson and E.O' Donnel, Flora and Fauna of Mageria, M.U.P., 1974 p.236.

The Pugot. Pugot are found only in Maurethalia and Mageria. They are a small antelope, usually standing no more than 50 cm. at the shoulder when fully grown, and weighing 5-6 kg. Gestation is about four months, resulting in one offspring.

Pugot generally pair for life, and each pair establishes its own territory. They are usually seen in pairs or in threes. They are extremely shy.

Their preferred habitat is grassland and woodland, though they tend to browse rather than graze. They are unable to survive long without surface water, and therefore are restricted, particularly in the dry season, to river valleys and lake shores.

There are two types of pugot, the northern (Rhynchotragus smithsonii) and the southern (R. reticula). The northern variety is a common antelope in Maurethalia where the large number of permanent river valleys form ideal habitats. R. reticula, which is distinguishable by its brown and black patchy markings, is found only around Lake Ann, in Mageria. Until recently it was present in sufficiently large numbers to be assured of survival. However, the influx of agriculturalists into the region since 1970 now poses a serious threat. It is thought that the number of southern pugot has dropped from about 6,000 in 1969 to only 4,000 today. There is little doubt that the pugot cannot compete in situations of high human or animal population densities, and any increase in either of these is marked by a decline in the number of pugot.

2E. Costs and benefits of the National Park to the Pastoralists

Costs:

Loss of dry season water points at Lake Ann.

Loss of access to pasture on shores of Lake Ann.

Benefits:

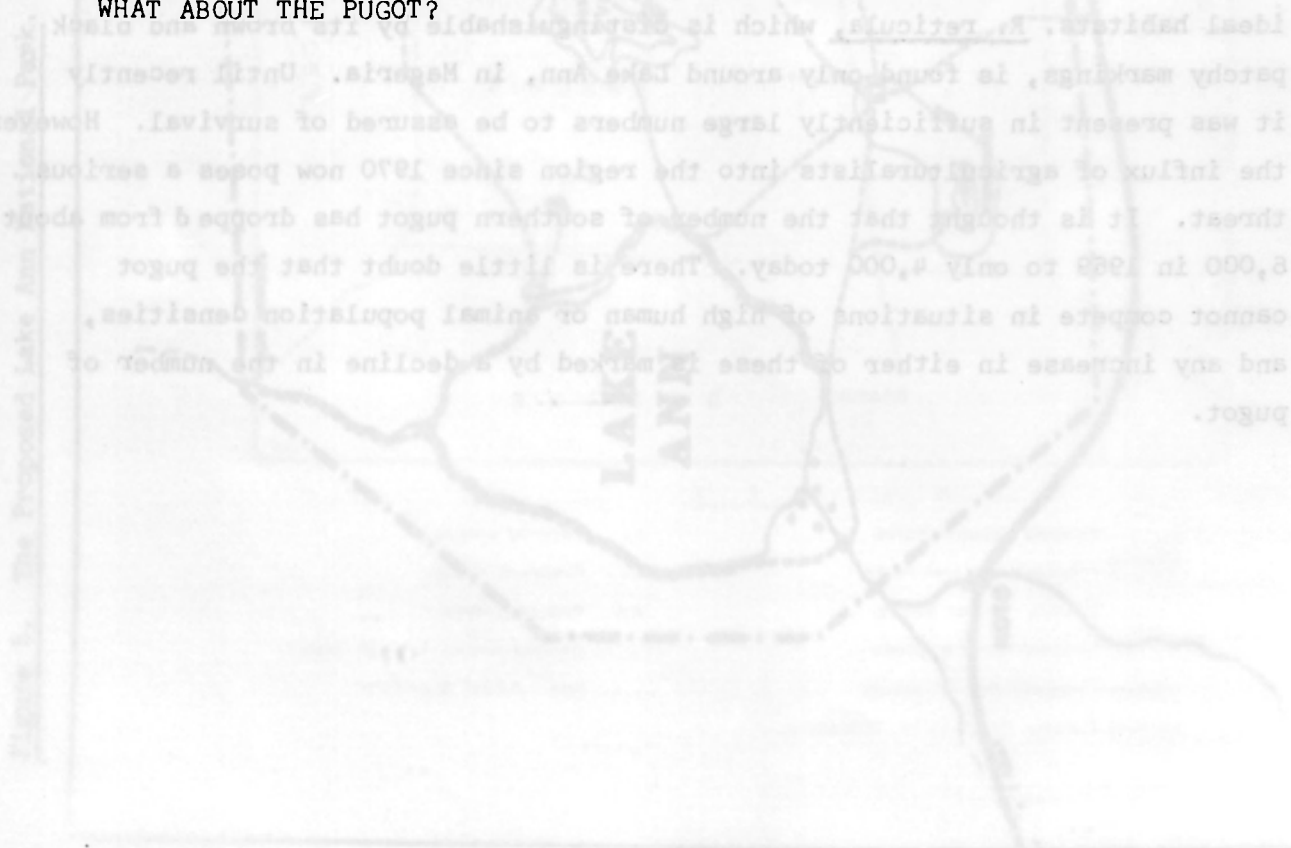
Potential employment at lodges.

Tarmac road **increases** potential for marketing animals. The World Bank notes that the 1969 Jones Report proposing an Integrated Livestock Development Plan for the area was rejected on the basis of cost and the inaccessibility of the region.

Handicraft outlet.

Revenue from organised tours to Tuai villages.

WHAT ABOUT THE PUGOT?



2F Costs and Benefits of the National Park to the Farmers

Costs:

Loss of farmland around Lake Ann.

Benefits:

Potential employment at lodges.

Tarmac road will improve marketing potential for local cash products.

In particular this should lead to an expansion of the area under coffee, and the possibility of exporting dairy produce out of the region.

Lodges will buy local vegetables.

Handicraft outlet.

WHAT ABOUT THE PUGOT?

Both pastoralists and farmers laid claim to the Liletan Hills. The pastoralists felt they had already sacrificed enough land in the Sengor Hills and along the Lake Ann shore, and that there was land available for the relocation of the Sengor at present settled in the Liletan Hills. The farmers made the case for return to dry-season grazing would be an under-utilization of scarce resources. The D.C.'s sympathies were with the pastoralists and he asserted that the Liletan Hills would be adjudicated for grazing use.

Some discussion took place regarding the possibility of the Sengor moving to the lower slopes of the Liletan Hills. This was ultimately rejected because of the traditional enmity between the Sengor and the Mossa. Another issue discussed was the possibility of tapping the water resources available to the Tset by building a pipeline northwards from Lake Ann to supply water at fifteen to twenty mile intervals. This proposal was rejected by the

A POSSIBLE SET OF SOLUTIONS

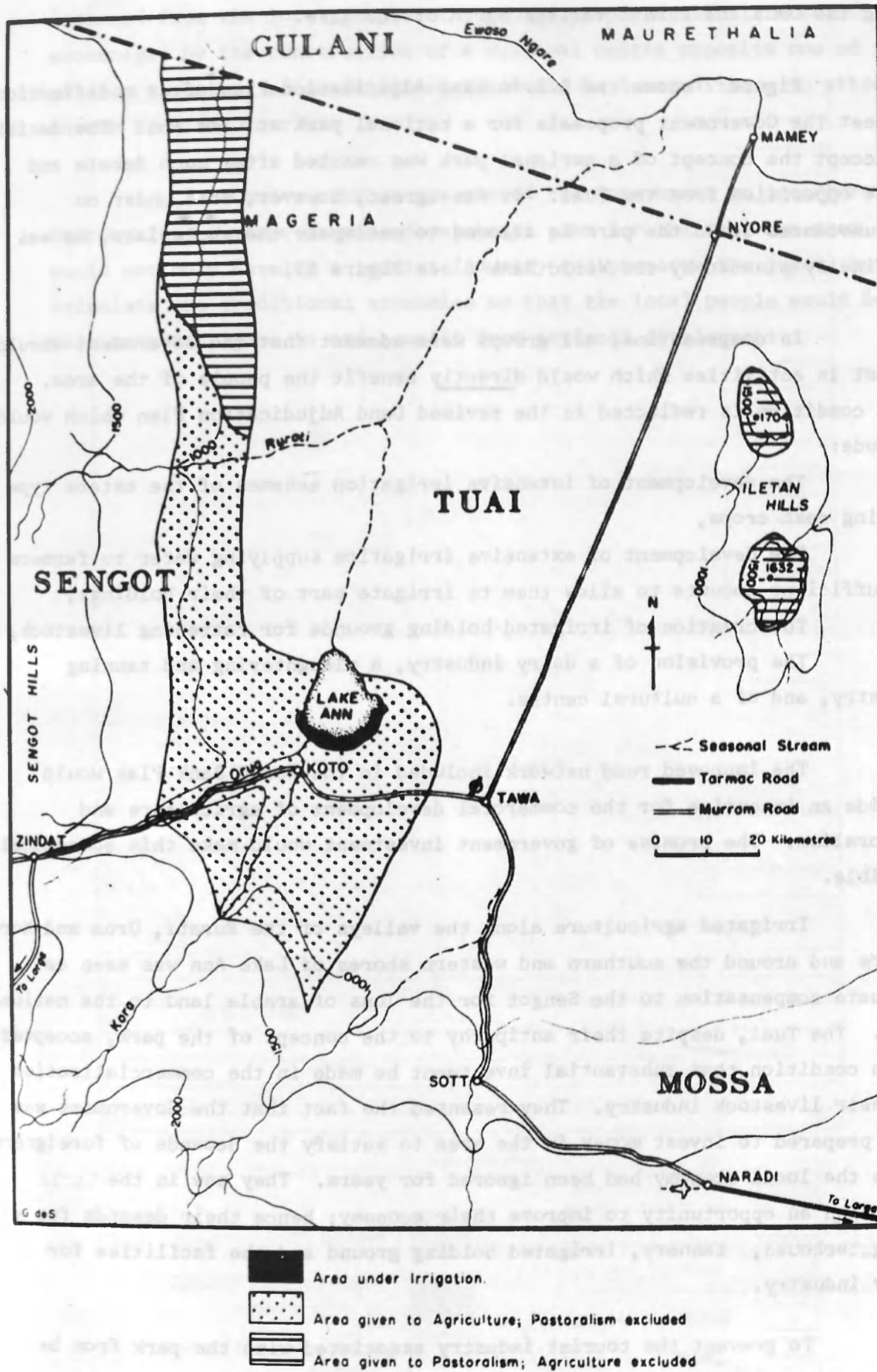
Figure 6 shows a composite solution to the first phase of the game, arrived at by the D.C. during one session. In producing their proposals, the participants concentrated on the areas of land-use conflict: the lower eastern slopes of the Sengot Hills, the Iletan Hills, and the irrigated area along the southern shore of Lake Ann. All groups recognised that the Sengot farmers required more arable land in order to meet the demands of a growing population, and that the most important factor for the Tuai was a guarantee of access to dry-season grazing and water. To resolve potential conflict, they sought to assign each area a single, specific land use.

With respect to the Sengot hillslopes and the Lake Ann shore, there was remarkable consensus amongst the groups. They all considered that the agricultural potential was sufficient to justify the official adjudication of part of these areas to agriculture. No group attempted to exclude the Tuai completely. Therefore the D.C. had simply to choose between the proposals to decide how much and which parts of the areas should be allocated to each land use. The only problem was to decide whether the farmers or the pastoralists should be given that part of the Sengot Hills immediately adjacent to the Maurethalian border, because of the security problem. The farmers considered that the Tuai, being more mobile and having a tradition of warfare, were better able to defend themselves against border raids. The Tuai felt that the Government would find it easier to police a community of sedentary farmers. Faced with this impasse, the D.C. opted for the former solution.

Both pastoralists and farmers laid claim to the Iletan Hills. The pastoralists felt they had already sacrificed enough land in the Sengot Hills and along the Lake Ann shore, and that there was land available for the relocation of the Sengot at present settled in the Iletan Hills. The farmers made the case that to return the land to dry-season grazing would be an under-utilization of scarce resources. The D.C.'s sympathies were with the pastoralists and he stated that the Iletan Hills would be adjudicated for grazing use.

Some discussion took place regarding the possibility of the Sengot moving to the lower slopes of the Esbats Hills. This was ultimately rejected because of the traditional enmity between the Sengot and the Mossa. Another issue discussed was the possibility of improving the water resources available to the Tuai by building a pipeline northwards from Lake Ann to supply wells at fifteen to twenty mile intervals. This proposal was rejected by the D.C.

Figure 6. Proposed Land Adjudication Plan.



in favour of an alternative plan to install wells tapping the groundwater along the Orua and Rurati Valleys north of the lake.

Figure 7 shows the D.C.'s Land Adjudication Plan after modification to meet the Government proposals for a national park at Lake Ann. The decision to accept the concept of a national park was reached after much debate and great opposition from the Tuai. It was agreed, however, that under no circumstances could the park be allowed to encompass the whole lake, as was originally planned by the World Bank (see Figure 5).

In compensation, all groups were adamant that the Government should invest in activities which would directly benefit the people of the area. This condition is reflected in the revised Land Adjudication Plan which would include:-

- 1) The development of intensive irrigation schemes of the estate type growing cash crops,
- 2) The development of extensive irrigation supplying water to farmers in sufficient amounts to allow them to irrigate part of their holdings,
- 3) The creation of irrigated holding grounds for fattening livestock, and
- 4) The provision of a dairy industry, a slaughtering and tanning industry, and of a cultural centre.

The improved road network included in the World Bank Plan would provide an incentive for the commercial development of agriculture and pastoralism. The promise of government investment would make this economically feasible.

Irrigated agriculture along the valleys of the Rurati, Orua and Kora rivers and around the southern and western shores of Lake Ann was seen as adequate compensation to the Sengot for the loss of arable land to the national park. The Tuai, despite their antipathy to the concept of the park, accepted it on condition that substantial investment be made in the commercialisation of their livestock industry. They resented the fact that the Government was only prepared to invest money in the area to satisfy the demands of foreigners, while the local economy had been ignored for years. They saw in the World Bank Plan an opportunity to improve their economy; hence their demands for a slaughterhouse, tannery, irrigated holding ground and the facilities for a dairy industry.

To prevent the tourist industry associated with the park from being

isolated from the local people, the groups proposed that interaction be encouraged by the construction of a cultural centre opposite one of the park gates. A variety of craft industries would be located there to attract an income from the tourists.

In summary, the groups wanted the Government to incorporate the local economy into a comprehensive development plan for the Lake Ann area. This plan would not only develop a tourist industry and preserve the pugot, but also stimulate the traditional economies so that the local people would be better able to participate in and benefit from national development.

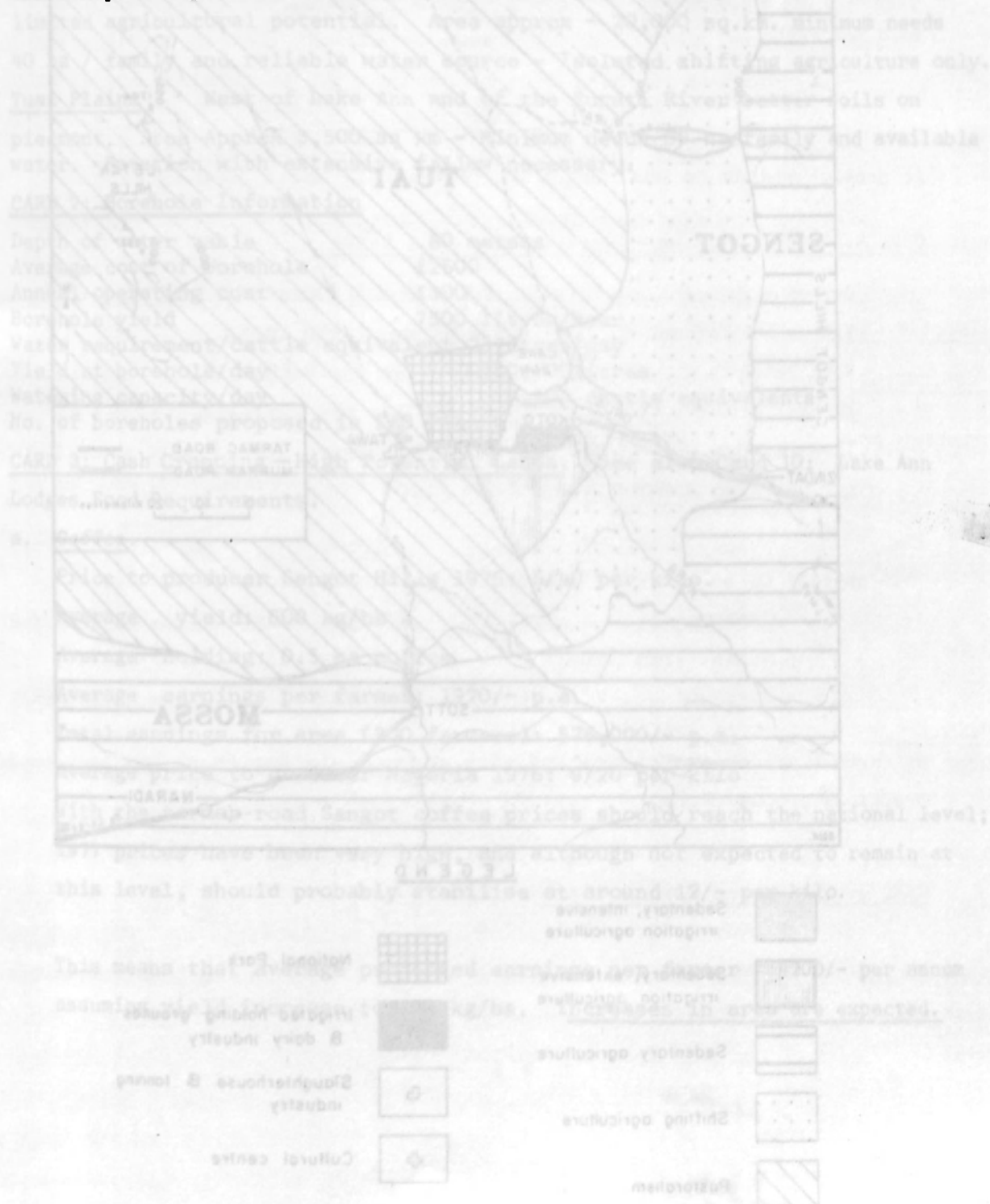
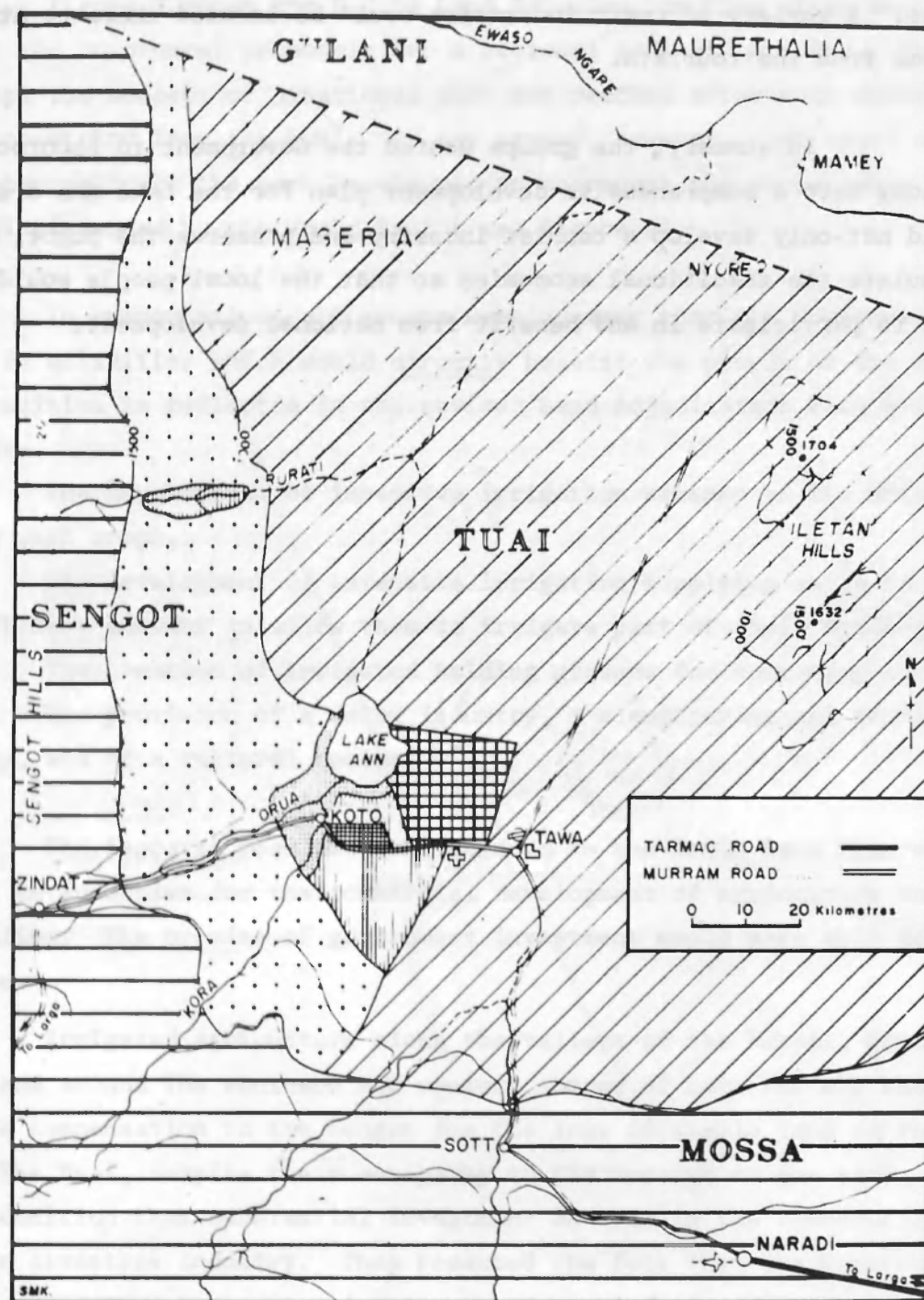


Figure 7. Modified Land Adjudication Plan Incorporating the Lake Ann National Park.



LEGEND

APPENDIX ONE: INFORMATION CARDS

Fifteen cards are available for consultation if the participants in the game feel they require additional information. These cards are reproduced in this appendix.

CARD 1: Agricultural Carrying Capacity of the Tuai Plains.

Lake Ann Shore - Length approx 50km within 100m of lakeshore - area approx. 5sq km - 60 families/sq.km. 100m-200m of lakeshore - area approx. 5sq km 30 families/sq.km.

Tuai Plains - South of lake, East of lake and of the Rurati River - very limited agricultural potential. Area approx - 20,000 sq.km. minimum needs 40 ha / family and reliable water source - Isolated shifting agriculture only.

Tuai Plains West of Lake Ann and of the Rurati River better soils on piedmont. Area Approx 3,500 sq km - Minimum needs 30 ha/family and available water. Rotation with extensive fallow necessary.

CARD 2: Borehole Information

Depth of water table	80 meters
Average cost of borehole	£2500
Annual operating cost	£300
Borehole yield	7500 litres/hour
Water requirement/cattle equivalent	25litres/day
Yield at borehole/day	180,000litres
Watering capacity/day	7,200 cattle equivalents
No. of boreholes proposed in FAO Plan	= 5

CARD 3: Cash Cropping --High Potential Lands. See also Card 10: Lake Ann Lodges Food Requirements.

a. Coffee.

Price to producer Sengot Hills 1976: 6/40 per kilo.
 Average yield: 600 kg/ha
 Average holding: 0.5 ha coffee
 Average earnings per farmer: 1920/- p.a.
 Total earnings for area (300 farmers): 576,000/- p.a.
 Average price to producer Mageria 1976: 9/20 per kilo
 With the tarmac road Sengot coffee prices should reach the national level; 1977 prices have been very high, and although not expected to remain at this level, should probably stabilise at around 12/- per kilo.

This means that average projected earnings per farmer = 4200/- per annum assuming yield increase to 700 kg/ha. Increases in area are expected.

b. Dairy products

At present there is no collection of milk from the area by the National Milk Board. It is expected that there will be a milk collection run once the tarmac road is constructed. Price to producer 1976 Mageria: 0/84c per litre whole milk. Average annual milk yield per cow: est. 1000L. This is a low figure on the assumption that grazing will not be optimal. Allows for non-milkers. This yields an income per cow of 840/- p.a.

C. Maize.

In future it is possible that maize now grown for subsistence purposes will be sold for cash.

Price to producer 0/70 per kilo

Average yields 1200 kg/ha

At present yields on the Sengot Hills are only about 1000 kg/ha.

CARD 4: Cash Cropping - Medium Potential Lands.

Cotton - drought resistant, needs about 300mm rainfall in growing season

Yields at present in Mageria only about 250 kg/ha

With extension work and inputs yields for Sengot Hills should be 100-1500 kg/ha. Price to producer 1976 was 2/- per kilo.

Thus returns should be 2000/- per ha gross, less inputs about 1000/- per ha. High labour requirement crop.

This appears to be the main possibility. Other alternatives are:

Castor:	1/- per kilo	1974
Millet (bulrush):	-/50 per kilo	1975
Sorghum:	-/25 per kilo	1975

At current prices (as shown) and with current yields, these are not considered practical propositions.

CARD 5: Estimated Family Size

Pastoralist: 9

Farmers: 7

CARD 6: FAO Report Integrated Livestock Development in the Lake Ann Plains,
Northern Mageria. Report of F.A.O. Investigation into the possibility
of expanding the livestock industry of Mageria. Chairman of the F.A.O. Team,
Sir Rodwell Jones.

Plan to develop integrated livestock utilisation facilities in the L. Ann area.
Proposed development of a slaughterhouse, tannery and leathercraft, tarmac road,
boreholes, dips, veterinary facilities and holding grounds. Tawa is the best
location. Investment funds DIBM(33%) and by the pastoral community (66%).
Project is cooperative enterprise integrating animal husbandry with animal-
based industry - 5 boreholes, 2 dips, veterinary facilities and purchase of
holding ground needed. Estimated cost £K20,000. This investment should be
made by the Ministry of Agriculture to stimulate the project.

SUMMARY BALANCE SHEET FOR PROJECT

Estimates based on 1965 data, annual basis

Population	68,000	Wholesale meat value @ 600/- carcass	30,000,000/-
No. of families	8,5000	Wholesale value leather products @ 450/- carcass	22,500,000/-
No. of shareholders	8,500	Total Income	52,500,000/-
No. of jobs in abattoir	40	Payments for stock @ 450/-	22,500,000/-
No. of jobs in tannery	40	Processing costs @ 200/- carcass	10,000,000/-
Cattle population	340,000	Wages:- 80x300/- per month	288,000/-
Subsistence needs	246,200	Salaries:- 4x£4000 per annum	320,000/-
Potential surplus	74,800	Recurrent costs inc. boreholes, etc.	8,241,000/-
Potential offtake 66%	50,000	Total Costs	41,349,000/-
Value of offtake @ 450/-	22,500,000/-	Profit	11,151,000/-
Mean value/family	2,647/-	TAX @ 10%	1,115,100/-
Mean initial investment/family	40/-	Returns to DIBM at 33%	3,341,955/-
		Returns to shareholders	6,693,945/-
		Returns to each family	787/-

CARD 7. Fishing Industry (Present and Potential)

Present catch rate: average 9kg. per canoe per night

Total yield per annum: est. 12.5 metric tons

Fishing methods: traditional from canoes or wading using gill nets, plunge baskets, traps. Varieties: Lake Ann is fresh water. Mostly Tilapia and Hapchromis. Most fishing is within 0 - 10m depth on lake, and in mouths and lower reaches of rivers.

All fish consumed locally. Fishing done by sub-clan of Tuai. Sengot do not eat fish. About 250 full-time fishermen in 11 small villages scattered round the Lake. They exchange their fish with the pastoral Tuai for animal products.

Catch volume is not expanding. This seems to be due to demand, not over-fishing.

Potential

See estimated costings prepared by Robertson, 1973.

Note that the potential sustainable offtake is much greater with a fish nursery.

Costing for commercial fishing industry

	<u>With nursery</u>	<u>Without nursery</u>
Offtake (potential sustainable)	250 metric tons/annum	150 m.t./annum
No. of boats (catch per hour 20kg.)	5	3
Employment: on boats	30 men	18 men
in cleaning factory	40 cleaners	25 cleaners
	4 foremen	2 foremen
	1 mechanic	1 mechanic
	2 management	2 management
Total	77	48
Revenue per annum at E.A. shillings		
5 kilo cleaned fish wholesale	625,000/-	375,000
Recurring cost p.a. (salaries, plant management, etc.)	500,000/-	350,000
Capital costs (on loan)		
Factory	60,000/-	60,000/-
Boats	300,000/-	180,000/-
Total	360,000/-	240,000/-
Loan repayments per annum	40,000/-	33,000/-
Total profit per annum	85,000/-	8,000/-

Loan repayments per annum

Total profit per annum

Only Feasible With Five Boats

Small profits suggests best run as co-operative.
Co-operative.

CARD 8: Irrigation Cash Crop Revenues

Cotton yields	2500 kg/ha	at 2/- per kg	5000/- per ha
Sugar yields	90t/ha	at 90/- per ton	8100/- per ha
Rice yields	7000 kg/ha	at 0/60 per kilo	4200/- per ha
Maize yields	8000 kg/ha	at 0/70 per kg	5600/- per ha.

CARD 9: Irrigation Potential

See also Card 10: Lake Ann Lodges - Food Requirements.

Irrigation is possible at two sites:

- Junction of Orua and Kora Rivers. Gravity fed. Size limited by water availability. Assuming good catchment management potential size 2000 ha.
- Shores of Lake Ann. Pump fed. Size limited by fuel costs for pumping. Economical to irrigate about 0.5 km back from lake edge (lift 0.9m) potential size 2500ha. round whole of lake shore.

Irrigation may be either 'extensive' or 'intensive'. Extensive - irrigation water supplied to farmers at economical rate, they do what they want with it. Usually best for furrow irrigation. Intensive-factory farming type - operations controlled by central authority. Costs and returns highest with intensive type

Number of people employed - assuming cash income of 4000/- per annum:

a. Without irrigation

Estimated carrying capacity Lake Ann shore	350 families in farming
Orua junction	500 families in farming
Total	850 families

b. With extensive irrigation Plot size 2.5ha

Lake Ann shore No. of farmers	900	Other workers	60
Orua junction No. of farmers	572	Other workers	30
Total -	1562	families	

c. With intensive irrigation Plot size 1.4 ha

Lake Ann shore No. of farmers	1600	Other workers	120
Orua junction No. of farmers	1430	Other workers	80
Total -	3230	families.	

<u>Capital costs</u>	Intensive per ha.	Extensive per ha	
		Direct to farmer	To constructing authority for canals, sluices, etc.
Bund irrigation	£2800	£800	£2000
Sprinkler irrigation	£1200	£1000	£200
Furrow irrigation	£2200	£200	£2000

Construction costs with extensive and intensive irrigation are regarded ultimately as costs to the farmer, to be recovered as part of the annual costs for water, etc.

Running costs

Intensive irrigation per ha. per annum.

Estimates include costs for fertiliser, seed, water, labour, plant maintenance. construction costs.

	Lake Ann	Orua junction
Bund irrigation	1600/-	800/-
Sprinkler irrigation	1500/-	900/-
Furrow irrigation	1400/-	600/-

N.B.: Costs for Lake Ann are higher due to diesel fuel requirements.

Costs for extensive irrigation are estimated to be 200/- per ha. per annum less, because there are fewer supervisory staff employed.

Crop types

Must be highly profitable

Intensive irrigation - must be one type to maximise efficiency.

Bund irrigation - rice

Furrow irrigation - cotton, sugarcane, market garden produce

Sprinkler irrigation - cotton, sugarcane, market garden produce

Extensive irrigation is more flexible.

Farmers may choose to grow slow maturing crops, e.g. tree crops, citrus crops.

Farmers may choose to grow subsistence crops under irrigation to ensure higher yields.

N.B.: Under extensive irrigation it is anticipated that the farmer will not irrigate all his land. Some will remain under grazing or low water requirement rain-fed crops.

CARD 10: Lake Ann Lodges - Food Requirements

If the lodges at the proposed Lake Ann National Park are built, they will provide a market for local produce. This may come either from the high-potential areas of the Sengot Hills or from small-scale irrigation schemes on the Tuai Plains.

Estimated annual requirements on the basis of 46,720 bednights per annum:

Potatoes	11,680 kg. at 1/50 per kg.	17,520/-
Tomatoes	4,672 kg. at 3/- per kg.	14,016/-
Carrots	4,672 kg. at 2/- per kg.	9,344/-
Lettuce	23,360 kg. at 0/50 each	11,680/-
Cabbages	9,344 at 2/- each	18,688/-
Cauliflower	6,674 at 3/- each	20,022/-
Beans	6,674 kg. at 1/- per kg.	6,674/-
TOTAL REVENUE FROM VEGETABLES		97,944/-

Eggs	7,787 dozen at 4/- per dozen	31,148/-
Chickens	9,344 at 8/- each	74,752/-
TOTAL REVENUE FROM POULTRY		105,900/-

Oranges	11,680 kg. at 3/- per kg.	35,040/-
Grapefruits	2,920 kg. at 3/- per kg.	8,760/-
Pawpaws	11,680 kg. at 2/- per kg.	23,360/-
Mangoes	11,680 kg. at 1/- per kg.	11,680/-

TOTAL REVENUE FROM FRUIT 78,840/-

TOTAL REVENUE OVERALL 282,684/-

These estimates are based on the assumption that farmers will be able to force prices up to near the level in Larga. Assuming a farm cash income of 4,000/- per annum, this trade would support 70 families.

Citrus fruits are not grown at present: Without these total revenue = 238,884/- which would support 60 families.

CARD 11: Pastoral Carrying Capacity of the Tuai Plains

Lake Ann Shore	- Length approx 50 km.
	- Within 2 km. of the lakeshore, area 100sq.km.
	- Capacity = 250 cattle equivalents/sq.km.
Tuai Plains ^a	- South of Lake, east of Lake and of Rurati River
Area approx. 20,000 sq.km.	- 15 Cattle equivalents per sq.km.
Tuai Plains ^a	- West of L. Ann and of the Rurati River
Area approx 3,500 sq.km.	- Piedmont area, better soils, more water available
	- 45 cattle equivalents per sq.km.

a. Carrying capacity given is for the dry season.

CARD 12: Rainfall Variability

Calculated according to the Coefficient of Variation = $\frac{\sigma}{x} \times 100\%$

	C.V.	σ (mm)
Nyore	37.1	97.02
Tawa	49.3	128.67
Koto	42.1	199.96
Zindat	37.9	297.52
Naradi	36.2	431.14

CARD 13: Selected Economic Characteristics of the Tourist Trade for the
Projected Lake Ann National Park.

NUMBER OF LODGES: 2

NUMBER OF BEDS PER LODGE: 80

TOTAL BED CAPACITY OF PARK: 160

PROJECTED REVENUES AT DIFFERENT OCCUPANCY RATES

	%	90%	100%
No. of visitors	46,720/-	52,560	58,400
Park entrance fee @ 20/-	934,400/-	1,051,200/-	1,168,000/-
Accommodation @ 200/-	9,344,000/-	10,512,000/-	11,680,000/-
TOTAL	10,278,400/-	11,563,200/-	12,848,000/-
Local Wages 60 x 300/- per month	216,000/-	216,000/-	216,000/-
Handicrafts at 20/- per visitor	934,732/-	1,051,200/-	1,168,000/-
Vegetables etc, sold to lodges	324,732/-	365,324/-	405,915
TOTAL LOCAL REVENUE	1,475,132/-	1,632,524/-	1,789,915/-

CARD 14: Wildlife Compensation Fees (W.C.F.)^a

WCF are designed to be paid to ranchers who permit wildlife to graze upon their land. They are intended to compensate ranchers for the pasture and water used by wildlife.

It is recognised that the amount of land available for ranching is being reduced by the encroachment of agriculture and by the enclosing of land, for the national park - at a time when the number of domestic stock is increasing. The loss of grazing and water due to the presence of wildlife is becoming increasingly significant and pastoralists, who have traditionally existed in relative harmony with wildlife, may find it necessary to exclude wildlife from their land.

In order to safeguard the wildlife resource upon which much of the tourist industry depends, it will become necessary to offer ranchers an incentive to allow wildlife to graze upon their lands. WCF intended to serve this purpose.

PROVISIONS OF WCF SCHEME

1. Numbers of wildlife of a ranch will be monitored by aerial and ground survey.
2. To qualify for WCF a ranch will have to be grazed by a minimum of 100 cattle equivalents.
3. WCF will be paid quarterly. Amounts paid will be 50/- per annum per cattle equivalent.
4. Any of the following restrictions on the activities of wildlife will incur a 25% reduction in WCF per restriction:
fencing of ranch; fencing of water point; harassment of animals;
poaching; legal hunting.
5. Under prevailing (1975) animal and human populations in the L. Ann area it is estimated that the annual average WCF payment per pastoral family will be 800/-

^a.. The concept of wildlife compensation fees is based upon a system of compensation known as wildlife utilisation fees which has been proposed by the Wildlife Management Project of the Kenya Ministry of Wildlife and Tourism and is currently under discussion by that ministry (Philip Thresher, personal communication).

CARD 15: Wildlife Population of the Lake Ann Area, 1975.

Species	Number ^a	Cattle Equivalent ^b	Total Cattle Equivalent
Elephant	300	10.0	3,000
Buffalo	20,000	2.5	50,000
Wildebeest	59,000	1.0	59,000
Zebra	30,000	1.0	30,000
Impala	14,000	0.2	2,800
Pugot	4,000	0.1	400
Thomson's Gazelle	12,000	0.1	1,200
Eland	3,000	2.5	7,500
Giraffe	1,000	4.0	4,000
Rhinoceros	200	4.0	800
Hippopotamus	60	10.0	600
Overall Total			159,300

a. Estimates based on aerial survey and sample ground reconnaissance.

b. Based on estimates of animal weights published in various sources.

APPENDIX TWO: GLOSSARY.

1. Age groups. The nomadic groups of Africa are generally divided vertically into age groups. The individual passes from one group to another through his life by a series of ceremonies which take place about once every seven years. The age range of individuals within any age group will therefore be about seven years.
2. Baraza. (Swahili). Local court. Now commonly applied to meetings called by local government officials for the purpose of passing on information to the people.
3. Boma (Swahili). Fortification. Now used to describe a homestead, or the collection of huts housing one family unit.
4. Borehole. A well sunk to the groundwater level to produce water either by gravity flow (in an artesian basin) or by pumping.
5. Carrying Capacity. Used here to mean the number of livestock units that the land can support without degradation. Very difficult to assess, particularly where climate is variable and the land use system is nomadic. In contrast, the grazing load is the actual number of livestock units that the land supports, which may be more or less than the carrying capacity.
6. Clans. Many nomadic groups of Africa are divided horizontally into extended family units known as Clans.
7. District Administration. The local government system in Kenya is based on the unit of the district, and we have used this system for the simulation. Each District has a District Commissioner, (D.C), who is responsible for general administration, and a number of other officers responsible for the supervision of various local activities; for example, crop production, range management, livestock and water. The districts are divided into Divisions, each of which has a District Officer in charge of the local administration.
8. Land Adjudication. Throughout Africa the traditional land holding systems are extremely complex, and vary among tribes in the way in which land is held and inherited. In an effort to adapt these systems to modern requirements, most governments have instituted land adjudication programmes. These seek to allocate plots of land to individuals, basing the allocation on

proven claim, and issue title deeds for the land. The major advantage for the individuals is that title deeds allow the owner to raise loans for land improvement by using the deed as collateral.

9. Land Potential. The economic potential of land, based upon the physical characteristic of the soils, climate and slopes. Land potential classifications are used in East Africa to assess the development potential, but are usually based exclusively on climate as the only commonly known parameter. Here we have used a mean annual rainfall of 600mm to separate medium from high-potential land.
10. Moran. An age group of young warriors who are responsible for the protection of the herds. In times of drought they break up the herds into small groups and move them over large distances in search of water and grass. At other times herding is largely the responsibility of the young children.
11. Murram. Laterite, used as a road surfacing material in the absence of tarmacadam.
12. National Parks. Government owned land which is reserved for the use of wildlife. Access is not permitted for any economic purpose such as grazing or farming.